as of the intermittent appearances of influenza, probably is that this is in Europe not an indigenous disease, but one imported from Asia. Possibly we may some day track it to its original home in the East, as the old plague and the modern cholera have been traced.

As regards, however, the European distribution of influenza, it has often been thought to depend upon the prevalence of easterly and north-easterly winds. There are many reasons for thinking that the contagium of this disease is borne through the air by winds rather than by human intercourse. One reason for thinking so is that it does not appear to travel along the lines of human communications, and, as is seen in the infection of ships at sea, is capable of making considerable leaps. The mode of transmission, too, would explain the remarkable facts noticed above of the sudden outbreak of the disease in certain places, and its attacking so many people simultaneously, which could hardly be the case if the infection had to be transmitted from one person to another.

Another important question, and one certain to be often asked, is suggested by the last—namely, whether influenza is contagious. During former epidemics great care was taken to collect the experience of the profession on this point, and its difficulty is shown by the fact that opinions were much divided. Some thought the disease could be transmitted by direct contagion, while others doubted it. But there was and is a general agreement that this is not the chief way in which the disease spreads, either in a single town, or from place to place.

We must avoid the fascinating topic of the cause of influenza, or our limits would be speedily outrun. But one simple lesson may be drawn from the facts already mentioned—namely, that the disease is not produced by any kind of weather, though that, of all possible causes of disease, is the one most often incriminated in this country. It is true that some of our worst epidemics have occurred in winter, but several have happened in summer; and the disease has been known in all parts of the world, in every variety of climate and atmospheric condition; so that it is certainly not due to a little more or less of heat or cold, moisture or dryness. Its constancy of type, the mode of its transmission, its independence of climatic and seasonal conditions, all suggest that its cause is "specific,"—that is, having the properties of growth and multiplication which belong to a living thing.

Whether the disease affects the lower animals is not absolutely certain, but the human epidemic has often been preceded or accompanied by an epidemic among horses of a very similar disease. It is pretty well known that such a disease is now very prevalent among horses in London. Nearly three weeks ago, one of the railway companies in London had 120 horses on the sick list, and the epidemic is still by no means extinguished. To a certain extent this must be taken as prognostic of human influenza.

It may be asked, if the influenza is really to come, can we form any notion how soon it is likely to appear? On such a point little beyond speculation is possible, for the rate at which the disease travels is extremely variable. Generally, it has taken some weeks, or even months, to traverse Europe, but occasionally much less, as, for instance, in 1833, when it appeared to travel from Berlin to Paris in two days. It is now barely a month since the epidemic became noticeable in Petersburg, where, according to a correspondent of the *British Medical Journal*, it began on November 15 or 17, though sporadic cases had undoubtedly occurred earlier. In the beginning of December it was already widely spread throughout Russsia, and, as it would seem from the published accounts, must have been in Berlin about the same time. In Paris the first admitted and recorded cases occurred about December 10, though doubtless there were cases before that date. Both public and private accounts report it exceedingly prevalent there now. In London, notwithstanding the abundance of colds and coughs, and the mysterious rumours which have been afloat, it appears to the present writer doubtful whether any cases of true influenza have yet occurred. But according to its apparent rate of progress, it might, if coming from Paris, have already arrived here; and it may be breaking out even while these lines are going through the press. But, on the whole, one would be disposed to give the epidemic another week or two. If its distribution depends, as it seems to do, on the winds, it is impossible to prophesy with much plausibility. A steady breeze setting in from one of the affected places might bring us an invasion in a very short time; but the current of air would have to be continuous over the whole district. Light local winds, whatever their direction, would, if the hypothesis be correct, have little effect. On the other hand, a steady frost, with an "anticyclone" period, might effectually keep off the disease. If, then, there is anything in the views above stated, prophecy belongs rather to the province of the weather-doctors than of the medical doctors.

Should the prospect seem a grave one, it may be some consolation to remember that an epidemic of influenza rarely lasts more than a few weeks—three to six—in one place; that it is rarely a fatal disease, though affecting large numbers of people; and that the present epidemic seems to have displayed on the Continent a decidedly mild type, which, according to the general rule, it is likely to retain.

J. F. P.

THE HORNY SPONGES.

A Monograph of the Horny Sponges. By Robert von Lendenfeld. (London: Published for the Royal Society by Trübner and Co., Ludgate Hill, 1889.)

WITHIN the last few years, and as a direct result of the famous Expedition of the *Challenger*, three most important monographs of the sponges belonging to the groups of the Hexactinellida, Monaxonida, and the Tetractinellida have been published, nor must the valuable contributions by Poléjaeff to the history of the remaining groups, Calcarea and Keratosa, be overlooked. The Calcarea had the advantage of having been already monographed by Haeckel, and so there only remained the Horny Sponges to be fully described, in order that the natural history of the sponges should be up to date.

Such a work has now been accomplished—thanks to the liberality of the Royal Society—by the labour and scientific skill of Dr. Robert von Lendenfeld. This monograph forms a fine quarto volume of over 900 pages, with an atlas of fifty lithographed plates.

While a student at the University of Graz, Lendenfeld tells us, his time was chiefly spent in the zoological laboratory of Prof. F. E. Schulze, then engaged on those researches on the natural history of sponges with which his name will ever be associated. This led him to take a special intest in the group, and to work out its history, first in the Mediterranean, and then at Melbourne and other places on the southern coast of Australia—a coast exceedingly rich in organisms of this class. From Melbourne, New Zealand was visited, and the Christchurch and Dunedin collections were examined. Next, that apparent El Dorado of the spongologist, Sydney, was explored, and, thanks to the splendid liberality of Sir William Macleay, Lendenfeld was enabled to establish a laboratory at the water-edge, and to study in a very thorough manner the sponges of this district.

With such abundant material, and with such ready help, nothing was wanting to work out the structural history of the species of the group. But to describe and name them, reference to type specimens was, above all things, necessary, and these latter were to be found most conveniently in the British Museum; thither, therefore, Lendenfeld came, early in 1886, at first resolved to write an account of the Australian Horny Sponges; but fortunately finding, during the progress of this work, that so great a proportion of the known forms were Australian, he determined to make a complete monograph of the group, and hence the volume which we proceed to notice.

This monograph of the Horny Sponges is divided into three parts: (1) an introduction, containing a brief historical summary and a detailed list of publications relating to sponges; (2) an analytical portion, devoted to the systematic description of all the known Horny Sponges; and (3) a synthetical part, in which the anatomy and physiology of sponges, especially of Horny Sponges, are treated, and their phylogeny, systematic position, and classification discussed.

Of the very extensive and scattered literature relating to the sponges, a most excellent bibliography is given; the papers are arranged alphabetically under their authors' names, but the publications of each author are given chronologically; the number of pages in each memoir is given, but, unfortunately, no reference is made to illustrations; abstracts and translations of papers are always quoted.

Considering the genus as "the important unit," the analytical part consists essentially of a series of monographs of the genera of Horny Sponges, but "species" as such are described; and the author has "done his best to make the different species equivalent," though this has been difficult of achievement. In those cases where he has felt compelled to establish varieties, he has followed the plan of E. Haeckel and F. E. Schulze, and has divided the whole species into "the requisite number of equivalent varieties." The total number of the species and varieties described amounts to 348, of which no less than 258 have been found in the Australian area.

It would not be possible, within any reasonable space, to give any satisfactory details of the analytical portion of this monograph. The descriptions of each genus are grouped into—an historical introduction; a sketch of the shape, size, colour, surface, and rigidity characteristic of the group; an account of the canal system, skeleton, with notes on the histology and physiology; the affinities of the genus; statistics of the species, with a key thereto, and details of distribution. Doubts must of necessity arise as to the exact limits that each author would ascribe to the species described by him, and in doubtful cases of this sort Dr. Lendenfeld has adopted the plan of placing no authors' names after them, but gives a full list of synonyms; we think it a pity that in these lists the memoirs, instead of being quoted, are simply referred to by numbers, for the explanation of which one must refer to the bibliographical list.

It is in the synthetical part, in which the general results are discussed, that the chief interest of this work lies, at least for the general reader. Here we have the questions of the general structure and evolution of sponges as a group considered, and their classification and systematic position discussed; and finally, as the fashion of some authors is, "an ancestral tree of the families" is given. Starting with the story of the metamorphic development of sponges, we find the primitive sponge defined as consisting of a simple ento- and ectoderm, and a thin mesoglœa—a very primitive mesoderm—between the two. Dr. Lendenfeld thinks that it is now generally acknowledged that the Physemaria, which Haeckel considered as "Gastreaden der Gegenwart," are not sponges at all, but Protozoa, so that they need not here be taken into account. Of course, it is evident that the views about these Physemarias, held at present by Haeckel, were, at the time of his thus writing, unknown to Dr. Lendenfeld. The modified Gastræa is traced onwards in its development, and the morphology of the adult structures are passed under review; their want of symmetry—and the exceptions are but few—is noted. None of the Horny Sponges are green; blue is never observed in the group, the range of colour being from light yellow to dark brown, light to dark red, and light to a dark, almost black, violet; the colour is lost in all, with a few exceptions, such as in *Aplysilla violacea*, when the sponge is preserved. The Horny Sponges would seem never to imitate their surroundings in colour, but it is suggested that in some cases the intense vivid colours may have the effect of frightening their enemies.

An attempt is made to account for the shape of the sponge conuli as the result of two pressure forces and to express this by formula. The biological student will scarcely be grateful for this, and is likely to be bewildered when he reads that "the conuli are hyperbolic rotatory bodies, formed by the rotating of the hyperbola,

$$y = (p \,.\, x)/(t + t \,.\, x),$$

round an axis parallel to the direction of pressure through the summit of the conulus." The canal system is described in some detail, the author not confining himself to the Horny Sponges. In contrasting this system in the Hexactinellida and the Hexaceratina, there seems some little confusion as to the comparative "tenderness" of the structures. The absence of spicules (siliceous) in the fibres is considered as the characteristic feature of the Horny Sponges, which distinguishes them from their siliceous ancestors; but in the superficial fibres of Aulena, echinating proper spicules occur; in the ground substance of several genera of Spongeliadæ, microsclera are to be found, while in Darwinella, triaxon horny spicules abound.

Very interesting accounts are given of the connective tissue, muscle cells, and nervous system. Stewart's account of the "palpocils" is accepted; and, although Prof. Stewart's specimens are the only ones which show these organs properly, yet Lendenfeld thinks that, when groups of converging sense-cells are observed (in sections) below the continuous surface, these may be regarded as the cells of a "retracted" palpocil.

The researches of the author have thrown but little fresh light on the subject of the occurrence of the strange "filaments" in the species of the genus Hircinia; these filaments are generally more abundant in the superficial layer than in the interior of the sponge. They may be isolated, or arranged in bundles of varying thickness, in which they are parallel. Such bundles are particularly conspicuous in *H. gigantea*, where they form a pretty uniform network which pervades the whole of the sponge. The filaments are never straight: they may be continuously and simply curved, or they are undulating. The latter form of curvature is particularly frequently observed in the filaments which are joined to form large bundles. While their abundance is subject to variation, no case of a sponge with but a few isolated filaments is on record. No apparent young stages of these filaments have been seen. Schulze's researches enabled him to make no positive statement concerning them, but they at the same time demonstrated that "no cellulose is contained in them, that they have no trace of true cellular structure, and that they contain a great deal of nitrogen (9·2 per cent. of their substance), and that they are not Algæ. The resistance of the filaments in boiling alkali is against their being ordinary Fungi, while their general chemical composition indicates no relationship to the ordinary sponge skeleton." As to the very minute dumb-bell shaped structures observed by Poléjaeff, and considered by him to be young stages of the filaments, Lendenfeld thinks that this is extremely doubtful, "particularly as nobody besides Poléjaeff has seen them in *H. friabilis* or any other sponge." But is this so? for in another paragraph we read:—

> "The spherical bodies which Schmidt and Poléjaeff consider as young stages of these filaments—in fact, as terminal knots, either dropped off, or on the way to produce a filament—have also been observed and carefully studied by Schulze, who considers them as monocellular Algæ, which have nothing whatever to do with the filaments."

Lendenfeld says that "no trace of filaments or 'spores' can be detected in the young embryos which are often found in specimens of Hircinia."

On the physiology of the group, this monograph throws but little light:—

> "Our knowledge of the vital functions of sponges is at present exceedingly unsatisfactory. We do not even know which parts of the sponge absorb nourishment, or, in fact, what kind of food the sponges take in. We are equally ignorant concerning their respiration and secretion."

There being then no facts to serve us as guides to knowledge, the next "best thing" is to have recourse to imaginations, and our author "thinks" that "it is by no means unlikely that the sponges may exclusively absorb liquid food—that is to say, organic substances dissolved in the water which is continuously passing through their canal system. All the other organisms in which arrangements are made to insure a continuous water current—I refer to the higher plants—absorb exclusively nourishing material in solution (the absorption of gaseous food by plants does not concern us here). The existence of a traversing canal system and a continuous water current seems to me to point to the nourishing material of sponges being in solution in the sea-water. The numerous fine sieves and filter arrangements generally, and the mere fact that the water always enters through the smaller holes and is expelled through the larger, clearly shows that the sponges are not desirous that large food-particles should enter their canal system."

Even granting that the word "exclusively" should be after the word "material," we do not quite understand the comparison of the well-known facts of plant physiology as they are presented to us in the above extract, nor see how it helps us to an understanding of how the sponge adds to its protoplasm; the undoubted power possessed by some of the sponge-cells to lay down silica, lime, &c., is quite different functionally from the phenomena attending growth and development, using these terms in Herbert Spencer's sense; but once set a thinking, our author proceeds, and telling us that a "tape-worm is an animal which takes up liquid food, and which has no special digestive apparatus, and that it evidently takes up a great quantity of material from the surrounding chyle through the apparently indifferent cylindrical ectodermal epithelium cells; that the excess material and waste products are got rid of by the nephrydia," he goes on to say that he is inclined "to think that in sponges we may have a similar mode of absorption of nourishment"; but then, where are the nephrydia or their analogues? and he thinks again "that it is not impossible that the ciliated chambers may be partly analogous to the nephrydia of the Cœlomata, and that the collar-cells may, besides performing other functions, also secrete the urine." However uncertain, he adds, this hypothesis may appear, "I think there can be no doubt that there is more probability in it than in the view, held by Carter and others of the older authors, that the ciliated chambers are merely digestive apparatus." This seems a rather dreamy hypothesis, with no facts for its foundation; but it is but fair to remark that it comes at the very end of a volume which is a record of numerous and important observations.

Under the headings variability, parasitism, and symbiosis, many interesting details are given. The author thinks that certain forms of Aulena and Chalinopsilla imitate "certain siliciferous Cornacuspongiæ. These sponges have descended from those which they imitate; and, whilst they have lost the spicules in the fibres, they have retained the outer appearance of their better protected ancestors in a most striking manner." Apparently, "the primordial sponge ancestors were free-swimming, and had no skeleton. Some produced a calcareous, others a siliceous skeleton; in both the subsequent development, the formation of ciliated chambers, which the ancestors did not possess, and the fixing of the axis and rays of the spicules, were the same. The primordial Silicea had indifferent irregular spicules, from which the triaxon and the tetraxon spicules were developed by an adaptation of the divergent development of the canal system. The primordial forms of both lived in water rich in silica, and certain forms of both lost their spicules in consequence perhaps, of rising from deeper to shallower water, where silica is more scarce. In both, some forms have lost the skeleton altogether, while others have replaced it gradually by spongin."

While acknowledging that some authors whose opinions must carry great weight, such as Balfour, Bütschli, and Sollas, consider the sponges as a separate group, equal in value to the groups Protozoa and Metazoa, Lendenfeld cannot but conclude that the sponges are, without doubt, Metazoa, and certainly Cœlentera, in the sense of being provided with a simple body cavity.

The last twenty pages of the work are devoted to a synopsis of all the known sponges, giving the classes, families, orders, and genera. In this extremely useful list there is a short analysis of the families and orders, which is based on the labours of Vosmaer, Ridley, Dendy, Sollas, Schulze, added to those of the author's own. The author ends his treatise with the statement that "Now that all the groups of sponges have been thoroughly investigated, we may consider our knowledge of their phylogenetic affinities established on a satisfactory footing" (p. 909); but it seems well to call to mind the statement with which he closes his short preface, and with which we feel the more inclined to agree, "our present knowledge of the group . . . has only just arrived at a stage corresponding to the knowledge of the higher animals of half a century ago" (p. 5).

In concluding our only too brief notice of this important work, for which all workers on the group must thank Dr. Lendenfeld, we may mention that the sponge portraits are for the most part photo-lithographs taken from the original types; though in a few cases, where no good specimens were available, the lithographic illustrations are from drawings.

THE FLORA OF SUFFOLK.

The Flora of Suffolk. By W. M. Hind, LL.D., Rector of Honington, assisted by the late Churchill Babington, D.D., F.L.S. With a Chapter on the Geology, Climate, and Meteorology of Suffolk, by Wheelton Hind, M.D., F.R.C.S. Pp. 508, with a Map. (London: Gilbert and Jackson, 1889.)

SUFFOLK is a characteristic lowland maritime English county, the flora of which, at the present day, contains absolutely no infusion of the boreal element. Its area is about 1500 square miles. The whole surface is flat, without any prominent rocks. It is underlain by chalk, which, in the north and west, lies immediately below the subsoil, but, in the south and east, is covered by Tertiary and Glacial deposits, which at Harwich have been found to reach a thickness of 1000 feet before the chalk is reached. In White's history of the county, its soils are classified into three groups: heavy lands, in which clay predominates; mixed land, common mixed soil, rich deep moulds, fen-lands, and rich marshes; and light lands, consisting of sand over chalk. To the first set belong the soils of the western two-thirds of the county, except in the extreme north and near the coast. The mixed lands are found—one portion east of the heavy lands between the Orwell and the Stour; a second in the north, between Halesworth and Yarmouth; and a third west of the heavy lands between Holston and Newmarket. The sandy, or light, soils are in the extreme north-west, in what is called the "Breck district," between Thetford and Mildenhall, where are found the rarest plants of the county, such as *Veronica hybrida*, *V. triphyllos*, *V. verna*, and *Apera interrupta*. The coast is remarkable for the extent of its tidal estuaries and bays, creeks and havens. There are no cliffs of any considerable height, but a great extent of sand and shingle. The beach at Orford, where grows the great mass of *Lathyrus maritimus*, the seeds of which saved the life of many poor people in a famine in the middle of the sixteenth century, is said to have the greatest breadth of sand anywhere on the English coast. The rivers are shallow streams with slow currents. In the north-east there are several lakes of brackish water, not so well known as the Norfolk Broads, of which Braydon Water covers 1200, and Thorpe Mere 1000, acres. The fresh-water lakes of the county are few and small. There is a considerable area of fen- and marsh-land, both in the north-west and east, so that we get in the county all the conditions that produce a rich low-country flora, and, superadded to the common lowland plants, rarities characteristic of chalk country, the seashore, and fen-land ditches and marshes.

The country is so easy of access from the centres where have lived many of the best botanists of bygone time, such as London, Cambridge, Yarmouth, Norwich, and Saffron Walden, that the principal features of its botany have long been known, and many excellent botanists, from the time of Buddle down to the present day, have resided within its compass. The father of Suffolk botany was Sir John Cullum, F.R.S., who lived near Bury St. Edmunds, and kept a diary between 1772 and 1785, in which he has recorded the occurrence of upwards of 500 plants. To his son, Sir Thomas Cullum, F.R.S., who was also an enthusiastic botanist, Sir J. E. Smith dedicated his "English Flora." In the present work there is not only a full general history of the progress of Suffolk botany, but, under each plant, the name of its first known collector is registered. The first "Flora" of the county was published in 1860. It was carried out mainly by the exertions of the late Mr. E. Skepper, working under the superintendence of Prof. Henslow. After it was published, Mr. Skepper made a great many notes for a new edition, but he died in 1867. For several years the Rev. Churchill Babington, who settled in the county in 1866, paid attention to the subject. In 1875, the Rev. W. M. Hind, a very competent botanist, well known by his "Flora of Harrow," settled in the county, and Dr. Babington sought and obtained his assistance to carry on the work. Dr. Babington died early in the present year.

The bulk of the book is, of course, occupied by the enumeration of the species and an account of the distribution and special localities of the varieties. The county is divided into five districts, and the distribution of the plants is traced through them. Only the Phanerogamia and Vascular Cryptogamia are dealt with, bu the mosses of the county have also been well worked.